

REMARKS

Favorable reconsideration is requested in view of the above amendments and the following remarks.

Claim Amendments

Claims 1 and 15 have been amended to include:
wherein step (iv) is terminated upon at least one termination criterion being satisfied, said termination criterion being defined in terms of a respective said threshold value based on a previously-derived mismatch value.

This amendment makes it more clear that the threshold value used to terminate the search for blocks is value based on a previously-derived mismatch value. None of the prior art of record shows this feature.

Rejections Under 35 USC 112, second paragraph

In response to the Examiner's comments in paragraph 1 of the Office Action, claims 12, 13 and 15 have been amended to provide proper antecedent basis.

Rejections Under 35 USC 103(a)

Claims 12, 13, 15, 24, 26, 35, 37, 39 and 40 have been rejected under 35 U.S.C. 103 (a) as unpatentable over U.S. Patent 5,717,470 to Jung and U.S. Patent 6,549,576 to Moriyoshi. Applicants respectfully traverse this rejection. Applicants have also added new claims 41 and 42 which are dependent on claim 12 by way of this response. No new matter has been added by way of these new claims, support

for the claimed features can be found on page 28 line 20 to page 29 line 2 of the description.

Applicants' invention, as well as Jung and Moriyoshi, can all compress frames in a video sequence using inter-frame prediction by motion compensation (motion estimation). These methods use a block matching method to determine a motion vector used for the motion estimation. A frame to be compressed (also referred to as the first image or current image) is divided into multiple blocks. For each of the blocks, a search is performed within a search area of a reference frame (either a previous frame or a future frame) to find the block most similar to the block in the current image. The similarity (mismatch value) between the blocks of the current image and reference image can be determined by such methods as sum of absolute differences, mean absolute difference, etc.

One problem with the basic block-matching method is that searching the reference frame for matching blocks is very slow, typically requiring 10^9 operations per second for standard television signals. This is because every pixel of the reference frame is searched and its corresponding block compared to the block of the current image. One way to reduce the number of required operations is to use the mismatch values to stop the search. When a reference block is found that is similar enough to the block of the current image, then the corresponding block has been found and there is no need to search the remaining blocks.

In Jung and also in Applicants' invention, the search for a matching block in the reference frame is terminated based on a comparison of the mismatch value and a threshold value. However, the threshold value in the Applicant's invention is determined and used to terminate the search using a new and non-obvious method

very different from that disclosed in Jung. In Applicants' invention, the threshold value is determined "based on a previously-derived mismatch value for at least one further block of the first image" (Claim 12) and "based on a mismatch value of a second block of the first image adjacent said first block" (Claim 15).

As admitted in the Office Action, Jung does not show "deriving at least one threshold value based on a previously-derived mismatch value for at least one further block of the first image" as claimed in Claim 12 and "deriving at least one threshold value based on a mismatch value of a second block of the first image adjacent said first block" as claimed in Claim 15.

The Office Action asserts (see page 4, second paragraph to page 5, line 2 of the Office Action) that Moriyoshi (column 2, line 40 to column 3, line 32) makes up for Jung's deficiencies by showing the claimed features of "deriving at least one threshold value based on a previously-derived mismatch value for at least one further block of the first image" as claimed in Claim 12 and "deriving at least one threshold value based on a mismatch value of a second block of the first image adjacent said first block" as claimed in Claim 15.

However, Claims 12 and 15 include additional subject matter that is not shown by Jung, Moriyoshi or the combination of the two. The claims include the search-termination feature not shown by Jung namely that step (iv) i.e. for successive zones, and for successive pixels in each zone, determining a block of the second image based on each successive pixel of said successive pixels "is terminated upon at least one termination criterion being satisfied, said termination criterion being defined in terms of a respective said threshold value based on a previously-derived mismatch value".

The combination of Moriyoshi with Jung does not teach these limitations. In Applicants' invention, the threshold value is used to indicate that a block in a reference frame has been found which corresponds to the block in the current frame. After the corresponding block is found, the claims recite that the search for the corresponding blocks in "successive zones, and for successive pixels in each zone is terminated". However, in Moriyoshi, the threshold value is used for the opposite purpose of indicating that a block in the reference frame does not correspond to the block in the current frame (see col. 3, lines 3-7: "the residual difference ... is compared with a certain threshold value and if the residual difference exceeds the threshold value, the calculation of the residual difference concerning said block is aborted and thereby, the amount of operation is reduced"). After Moriyoshi rejects a block in the reference frame based on the threshold value, the search for the corresponding block continues, unlike Applicants' invention where the search for the corresponding block is terminated. In other words, in Applicants' claimed invention the threshold value is used to terminate the search for blocks while in Moriyoshi the threshold value is used to terminate the mismatch value calculation.

Thus, even if Moriyoshi were combined with Jung, they would not teach Applicants' claimed invention. Additionally, if Moriyoshi could be combined with Jung, it would be combined to teach step (iv) of Applicants' Claims 12 and 15 (the step of "determining the mismatch values between said first block of the first image and said determined block"). In particular, Moriyoshi's threshold would be used to end the mismatch calculations for individual blocks when, during the mismatch calculation, the partially calculated mismatch value becomes larger than the threshold value. However, this combination of Jung and Moriyoshi would still not

teach the claimed recitation that "step (iv) [for successive zones, and for successive pixels in each zone, determining a block of the second image based on each successive pixel of said successive pixels] is terminated upon at least one termination criterion being satisfied, said termination criterion being defined in terms of a respective said threshold value based on a previously-derived mismatch value".

Additionally, the Applicants respectfully traverse the statement in the Office Action that Moriyoshi discloses "threshold value determination based on a previously derived minimum mismatch value for at least one further block of the image and deriving at least one threshold value based on a mismatch value of a second block of the image adjacent the first block". In the passage describing the setting of the threshold (col 3, lines 22-32) the threshold is clearly continually being reset, and this is during the searching based on the search area (i.e. at a time corresponding to step (iv) of claims 12 and 14). In other words, as in Jung, thresholds are set during what, in the present invention, corresponds to step (iv) of the method, and not "before" it.

The feature of varying the threshold during the scanning of a search area (i.e. what is taught in Jung and Moriyoshi) teaches against the present invention as claimed in both Claims 12 and 15 and therefore both these claims are patentable in comparison to the citations. All other claims depend upon one of these two claims, and therefore are patentable for the same reason.

All other previously pending claims depend from Claims 12 or 15 and are thus also new and non-obvious over all the prior-art of record taken alone and in combination.

New Claims 43-46

Applicants, have by way of this response, added new claims 43-46. New independent claim 43 incorporates all the features of claim 15 and an additional feature of deriving in step ii) at least one further threshold value using a previously-derived mismatch value of a block of a third image corresponding in position to said first block of the first image. Both the threshold value based on a mismatch value of a second block of the first image adjacent said first block (original feature of claim 15) and the further threshold value are used for terminating the search for a matching block (i.e. step iv). Support for this further threshold value is found on page 10 of the description.

The added claimed feature of “deriving at least one further threshold value using a previously-derived mismatch value of a block of a third image corresponding in position to said first block of the first image” is not shown by Jung, Moriyoshi or the combination of the two. Also, the further threshold value is determined prior to the search for a matching block (i.e. step iv) unlike Jung and Moriyoshi where the threshold values are constantly reset during the search. Therefore, since claim 43 incorporates all the features of claim 15 and additionally includes a feature also not found in Jung and/or Moriyoshi, Applicants submit that claim 43 is patentable over Jung and Moriyoshi, alone or in combination. Accordingly, claims 44-46 which are dependent on claim 43 are also patentable over the cited documents.

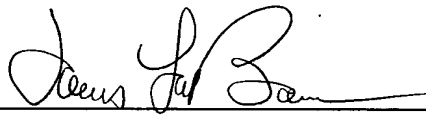
Conclusion

It is submitted that the claims as amended are in condition for allowance.

Respectfully submitted,

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Date: August 13, 2004

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